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DESTRUCTION OF LOG PERCH EGGS BY SUCKERS.

While collecting eggs of the log perch, *Percina caprodes*, (Rafinesque), at Douglas Lake, Michigan, during the second week of July, schools of suckers, *Catostomus commersonii* (Lacepede), were observed raiding the spawning grounds of the log perch. These suckers quietly entered the schools of log perch which were spawning in the shallow water near shore, and crowded the spawning fish aside to eat their recently laid eggs. The suckers were shy and retired to deep water when disturbed, returning again to the spawning grounds as soon as opportunity offered. They were seen in and near the schools of log perch throughout the day, for nearly two weeks.

Twenty of these suckers were captured about 9:30 A. M., while feeding among the log perch. Five were killed at once. The remaining 15 were placed in a live-car some distance from the spawning grounds and killed at intervals during the next 24 hours. The entire alimentary canal of each suckers was examined immediately after each fish was killed, and the number of log perch eggs noted. The data are tabulated below:

No.	Body length mm.	Sex	Time in live-car	Eggs in ali. canal	Sand in ali. canal cc.
1	290	male	0	452	11.00
2	300	"	0	1,243	9.00
3	290	"	0	607	8.50
4	285	"	0	475	6.00
5	305	female	0	745	9.50
6	305	"	1 hr. 30 min.	704	4.50
7	265	male	1 hr. 45 min.	1,475	7.00
8	280	"	2 hrs.	246	3.00
9	290	"	3 hrs. 45 min.	649	8.00
10	280	"	3 hrs. 45 min.	222	5.00
11	270	"	4 hrs.	389	2.00
12	280	female	4 hrs.	23	2.50
13	310	male	4 hrs. 30 min.	64	0.75
14	315	"	5 hrs.	333	6.00
15	230	"	5 hrs.	390	2.00

Temperature of water in live-car 19° C.

From the table it may be seen that the average number of eggs in each alimentary canal was 500, and that two individuals each contained over 1,200 eggs. These figures do not include the partially digested and crushed eggs, as only whole eggs and recently-ruptured eggs were counted. The intestinal contents of all of the 15 suckers examined, however, included oily masses of partially digested eggs. This average of 500 eggs per sucker is also probably lowered through the loss of eggs crushed or digested while the fish were in the live-car, as but one-third of the 15 averaged were killed immediately after their capture on the spawning grounds. Aside from the eggs of *Percina caprodes*, the alimentary canals of these suckers contained little or no organic material, but fine sand was always mixed with the eggs. This fine sand undoubtedly was swallowed with the eggs, a portion of it at least attached to them, as the eggs of the log perch are covered with a coat of sand and debris shortly after leaving the body of the female. The average volume of sand in each alimentary canal was about five times the average volume of unbroken eggs present, as one cubic centimeter of log perch eggs contains about 440 eggs.

The remaining five suckers were killed after 24 hours of isolation in the live-car. No whole eggs were found in the alimentary canals of these fish, and only small masses of oil and sand were present in the posterior portions of the intestines. The absence of eggs in the alimentary canals of these five fish, collected while feeding with the other 15, considered with the fact that the alimentary canals of the other 15 contained an average of 500 eggs each, suggests the possible consumption of at least 500 log perch eggs every 24 hours by each sucker following the schools of log perch. The actual destruction of eggs by each sucker is probably greater, however, as the broken eggs remain uncounted. The percentage of the total number of eggs produced by the female log perch of these schools, destroyed by the suckers was not ascertained. Several female log perch taken at random yielded about 100 mature eggs each, although the ovaries of these fish contained large numbers of immature eggs.

While considering the destruction of the log perch eggs by suckers it may be noted that the log perch themselves crowd about spawning individuals of their own species and devour the recently-laid eggs. Ten male log perch collected with the suckers were examined and from eight to 20 eggs were found in the stomach of each one.

M. M. ELLIS,
G. C. ROE,
Boulder, Colorado.

NOTES ON THE BREEDING AND INCUBATION PERIODS OF THE IOWA, DARTER, *ETHEOSTOMA IOWAE*
JORDAN AND MEEK.

While collecting embryological material during the spring of 1917 the eggs of the Iowa Darter, *Etheostoma iowae*, were obtained, fertilized and carried through the hatching period.

This darter is abundant in some of the foothill streams near Boulder, Colorado. Males in full breeding colors, with milt flowing freely when touched, and females with mature ova which could be discharged with slight pressure, were found as early as April 22 and as late as June 1, in Dry Creek, a small stream a few miles east of Boulder. These breeding fish were taken in water from three to four feet deep. The temperature of the water varied from 12°C. to 15°C., and its alkalinity equaled a 1-800 normal solution of Potassium Hydroxid. The darters were especially fond of pools where the bottom of the stream was covered with a heavy slime and masses of rotting vegetation, which had to be removed before the fish could be captured. When disturbed, the darters, which could be seen resting on top of this slime, burrowed into the soft debris by a series of quick movements of the pectoral and ventral fins. This preference for the deep pools at this time seemed to be correlated with the breeding activities of this species, as *Etheostoma iowae* was found usually under pebbles in swiftly running water and in shallow riffles during the fall, winter and early spring.

The incubation period of the eggs of *Etheostoma iowae* kept in running water at 13°C. to 16°C. in the laboratory, was comparatively short, occupying from 18 to 26 days. The germ ring was clearly visible by the twentieth hour after fertilization, and the majority of the eggs of one large series hatched within 30 minutes of each other on the twenty-fourth day. The newly-hatched darter was 3.4 millimeters in length.

BERTRAM B. JAFFA,
Boulder, Colorado.

THE BREEDING HABITS OF THE VIVIPARUS PERCH, CYMATOGASTER.

The family Embiotocidae includes a number of interesting percoid fishes. They have all developed

viviparity to a high degree of perfection, the young being born in an almost adult condition. Very little has been written of their habits, and apparently nothing at all of their copulation. So it was with much satisfaction that I observed, under very favorable circumstances, the breeding habits of *Cymatogaster aggregatus*. The date of the observation was July 5, 1916; the locality was in the shallow channel forming the outlet and inlet of an estero near Goleta in Santa Barbara County, California.

Attention was first directed to a slight disturbance about twenty feet offshore, where two "Shiners" were swimming with their backs just out of the water. Very soon the pair were joined by about 6 others, which, judging from their small size, were likely males. The original pair swam slowly towards shore, their caudal regions in close proximity. The largest of the supernumerary fishes immediately preceded the pair, while the others followed a short distance behind. Occasionally the male turned partly over onto his side. After the fishes had proceeded thus shoreward about 6 feet, there ensued a commotion, of which the details were not observed, and then all but the first pair swiftly made for deeper water offshore.

The pair, now alone, then proceeded against the tide in a semi-circular course of about five feet, frequently pausing while the male, turning upon his side, applied his anal region to that of his mate. Finally reaching the shelter of a stone in about a foot of water, the pair halted and copulation ensued. With their heads in the same direction and their anal regions in contact, the pair remained quite motionless for a few seconds, seeming to balance in the water. The male then turned over to a nearly horizontal position, the female much less. For several seconds the male moved rather slowly about half an inch back and forth, paused, then resumed the vibratory move-

ment for a few seconds, and finally darted off, without warning into deeper water.

The female remained quite motionless in the shelter of the stone, and was readily captured in a seine. Its oviduct was loosely extruded for about 5 mm., and from it there projected the tail of the single remaining young. This young fish was about of the same size as numerous others seined nearby, most abundantly over the bottom where strewn by kelp washed in by the tide.

This observation confirms other evidence that the period between copulation and the bearing of the young is one year.

The life color of this breeding female may be of interest. The gold color appears in the usual two bars across the middle of the brilliantly silver sides, which are tinged with gold posteriorly; there is also a smaller bar before these, and a trace of one along the margin of the branchial aperture. There is a blotch before the pectoral fin, and another small blotch which is located behind and below the pectoral, and is followed by a streak extending nearly across the trunk.

CARL L. HUBBS,
Chicago, Ill.

NOTES ON THREE COMMON NEW JERSEY TURTLES.

These notes are taken essentially word for word from my notebook.

Mating of Box Turtles and of Wood Turtles.
I have twice found turtles apparently either mating or just after or about to begin mating, though on neither occasion could I see any connection other than that one was sitting squarely on the other's back. Evidently, however, it was neither time a case of casually sprawling over each other like Painted Turtles on a crowded sunning-log. The Box Turtles

(*Terrapene carolina*), were on land in the woods bordering the bank of Crosswicks Creek below Crosswicks, Burlington County, May 9, 1915. I noted particularly that the plastrons of both were decidedly concave and to the same degree. The Wood Turtles (*Clemmys insculpta*), were resting on the bottom of a little brook in the Washington Valley above North Plainfield, Somerset County, May 14, 1916. The brook at that point flows through open fields more or less bushy. The turtles made off when disturbed, one going up stream and one down.

Egg-Laying of a Painted Turtle. On July 4, 1916, a I found a *Chrysemis picta* at Runyon, Middlesex County, just within the fringes of short grass, *Arenaria*, etc., on the far side (from the pond) of an open space in the woods on the north side. She had dug a hole at least four inches deep (perhaps much more), and was laying eggs. I saw her lay three, at brief intervals. She would poke each one down among the others and pack it in with one or the other hind foot. After laying the last, she shoveled the sand back over them with her hind feet (which, normally so far apart, were brought to meet and even overlap), stamping and pushing it down, awkwardly, but so painstakingly and efficiently that when she had finished the spot was indistinguishable. The hole was less wide than deep, and the top eggs were under about an inch or two of sand. During the whole operation, the turtle's head (about half out), and body remained practically motionless, and I believe that she never saw her eggs, unless while I was away briefly she turned around expressly to look at them. All I have described (took place between five and six in the afternoon), she did while I stood close over her where she must have seen me. The animal had come about 120 yards from the pond, first through dense bushy growth (*Chamaedaphne*, etc.), then all the way across the open space where her track, fairly straight, was plainly visible. After cov-

ering her eggs she sat quiet, apparently resting before starting the long walk back to the pond.

CHARLES H. ROGERS,
New York, N. Y.

POISONOUS SNAKES IN THE JUNGLE.

It is quiet commonly maintained that poisonous snakes are very abundant in the tropics. After experiencing several months intensive collecting in Central American jungles, and after discussing the matter with other collectors who have likewise worked in the tropics, it is the writer's belief that poisonous snakes are not nearly so common as is generally supposed. The *species* are fairly well represented, but the actual number of specimens is comparatively less than in the case of the harmless forms. We employed natives to collect for us and few, if any, brought in any poisonous examples. They maintained that the venomous snakes were super-abundant and considered all annulated snakes (*Polydontophis annulatus*, *Coronella micropholis*, *Urotheca elapoides*, *Oxyrhopus* sps., and others), to be coral snakes, and all darkly colored, spotted snakes (*Xenodon*, *Leptodira*, *Petalognathus*, etc.), to be species of *Lachesis*. Many times were we given perfectly harmless forms which were considered by the natives to be either Elapine or Crotaline species. Hence, their usual statement of poisonous snakes being very abundant.

It is therefor advisable that the collector going into the usual tropical jungles should not entertain too high expectations in his quest for a large percentage of poisonous snakes, for he is very liable to have his hopes suddenly shattered.

CLARENCE R. HALTER,
New York, N. Y.

